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Final

No Further Action  
Decision Document - Site 85  
Marine Corps Base  
Camp Lejeune, North Carolina  
CLEAN III

Prepared For



**Atlantic Division**

**Norfolk, Virginia**

Contract No. N62470-02-D-3052

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Environmental, Inc.

5/1/05 - 03738

**FINAL**

**NO FURTHER ACTION  
DECISION DOCUMENT**

**SITE 85**

**MARINE CORPS BASE  
CAMP LEJEUNE, NORTH CAROLINA**

**MAY 2005**

**CONTRACT TASK ORDER 0060**

*Prepared for:*

**DEPARTMENT OF THE NAVY  
MID ATLANTIC DIVISION  
NAVAL FACILITIES  
ENGINEERING COMMAND  
*Norfolk, Virginia***

*Under the:*

**NAVFAC CLEAN III Program  
Contract N62470-02-D-3052**

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A	State of North Carolina Approval Letter
B	USEPA Region IV Approval Letter



## ACRONYMS AND ABBREVIATIONS

AM	Action Memorandum
ARAR	Applicable or Relevant and Appropriate Requirement
Baker	Baker Environmental, Inc.
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CLP	Contract Laboratory Procedure
COPC	Contaminants of Potential Concern
DD	Decision Document
DoN	Department of the Navy
EE/CA	Engineering Evaluation/Cost Analysis
FFA	Federal Facilities Agreement
FS	Feasibility Study
HQ	Hazard Quotient
ILCR	Incremental Lifetime Cancer Risk
IRP	Installation Restoration Program
LANTDIV	Atlantic Division Naval Facilities Engineering Command
LTM	Long Term Monitoring
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
msl	mean seal level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NC DENR	North Carolina Department of Environment and Natural Resources
NCWQS	North Carolina Water Quality Standards
NFA	No Further Action
NFRAP	No Further Response Action Plan
NPL	National Priorities List
NTCRA	Non-Time Critical Removal Action
OHM	OHM Remediation Services Corp.
PA	Preliminary Assessment
Pre-RI	Pre-Remedial Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study

## ACRONYMS AND ABBREVIATIONS

*(Continued)*

RAB	Restoration Advisory Board
RAC	Remedial Action Contractor
RBC	Risk-Based Concentrations
RRRS	Relative Risk Ranking System
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Society

## **DECLARATION**

### **SITE NAME AND LOCATION**

Site 85  
Camp Johnson Battery Dump  
Marine Corps Base, Camp Lejeune, North Carolina

### **STATEMENT OF BASIS**

This No Further Action (NFA) decision is based on the results of the following documents and actions completed for Site 85: the Pre-Remedial Investigation (Pre-RI) Screening Study conducted in September 1995; the Engineering Evaluation/Cost Analysis (EE/CA) completed in September 1999; the Action Memorandum (AM) completed in September 1999; the non-time critical removal action (NTCRA) performed during the period between October 22, 1999 and December 21, 1999 and follow up Closeout Report for the Remediation of Site 85 completed in December 2000; and post NTCRA groundwater sampling. The Pre-RI Screening Study included installation of temporary groundwater monitoring wells and associated soil and groundwater sampling. Through the Pre-RI Screening Study, it was determined that Site 85 required remediation through a NTCRA for the battery piles and associated contaminated soil. The EE/CA was prepared to evaluate remedial alternatives for the inorganics in Site 85 soil and subsequently, documented in the AM. The Closeout Report prepared after the removal action at Site 85 contains confirmatory sampling that verifies the removal of soil contamination. Following the removal action, five monitoring wells were installed in the area of the removal actions to monitor inorganics in the shallow groundwater. Five rounds of groundwater sampling indicated that inorganics are below the Federal and/or state standards at Site 85 and the contamination from the former battery piles is no longer impacting the shallow groundwater.

The Department of the Navy (DoN) and the Marine Corps have obtained concurrence from the State of North Carolina Department of Environment and Natural Resources (NC DENR) and from the United States Environmental Protection Agency (USEPA) Region IV on the selected remedy. Copies of the NC DENR and USEPA approval letters are presented in Attachments A and B.

### **DESCRIPTION OF THE SELECTED REMEDY**

Based on the current conditions at Site 85, it has been determined that the source removal action and the five rounds of post removal monitoring through the Long Term Monitoring (LTM) program for shallow groundwater, no threat to public health exists. Therefore, no further action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), is warranted.

### **DECLARATION STATEMENT**

This NFA Decision Document (DD) represents the selected action for Site 85, developed in accordance with CERCLA, as amended by SARA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Because contaminant levels at the site present no known significant threat to human health, it has been determined that no further action is protective of human health, attains Federal and state requirements that are applicable or relevant and appropriate and is cost-effective. The statutory preference for treatment has been satisfied through the NTCRA and post removal action monitoring for inorganics in shallow groundwater. With the removal of the battery piles and associated contaminated soil, contaminants will not impact the groundwater. Even though the source of contamination has been removed in the soil, LTM was implemented for the shallow

groundwater because some inorganics in shallow groundwater exceeded screening values during the Pre-RI, including Federal Maximum Contaminant Levels (MCLs) and/or North Carolina Water Quality Standards (NCWQS). The groundwater monitoring was performed on a quarterly basis for a period of one year and three months and inorganic concentrations were not detected above the Federal and/or state criteria. Groundwater monitoring has insured that contamination is no longer impacting the shallow groundwater at Site 85 and the inorganics in groundwater are acceptable according to Federal and/or state standards. It has been determined through the removal action and post removal action groundwater monitoring that no potential human health risks are posed by the inorganics in groundwater.

Brynn T. Ashton

4-27-05

Signature

Date

Mr. Brynn T. Ashton

Head, Environmental Quality Branch, Environmental Management Division

Installation and Environment Division

Marine Corps Base, Camp Lejeune, NC

## **DECISION SUMMARY**

### **1.0 INTRODUCTION**

Marine Corps Base (MCB), Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL) on October 4, 1989 (54 Federal Register 41015, October 5, 1989). Subsequent to this listing, the United States Environmental Protection Agency (USEPA) Region IV; the North Carolina Department of Environment and Natural Resources (NC DENR); and the United States Department of the Navy (DoN) entered into a Federal Facilities Agreement (FFA) on March 1, 1991 (effective date) for MCB, Camp Lejeune. The objectives of the FFA are:

- To ensure that the environmental impacts with past and present activities at MCB, Camp Lejeune are thoroughly investigated and appropriate CERCLA response actions are developed and implemented as necessary to protect the public health, welfare and the environment;
- To establish a procedural framework and schedule for developing, implementing and monitoring appropriate response actions at MCB, Camp Lejeune in accordance with CERCLA, the NCP and USEPA policy relevant to remediation at MCB, Camp Lejeune; and
- To facilitate cooperation, exchange of information and participation of the parties in such action.

The Fiscal Year 2003 Site Management Plan for MCB, Camp Lejeune, the primary document referenced in the FFA, accounts for each of the sites at the Base and provides detailed strategic planning. Many of the sites listed in the FFA have been investigated through the completion of Remedial Investigation/Feasibility Studies (RI/FS). Several sites, including Site 85, did not warrant a full scale RI/FS. As such, these sites were investigated by completing Pre-Remedial Investigation (Pre-RI) screening studies. The goal of these investigations was to determine if a full Remedial Investigation (RI) study was necessary or if a decision of no further action was appropriate.

This No Further Action (NFA) Decision Document (DD) supports no further action for Site 85. The purpose of this NFA DD is to summarize the existing data for the site and to describe the Marine Corps' rationale for no further action. Even though it has been determined through site-specific risk

analysis that removal of the source of contamination in the soils will provide no potential human health risks at Site 85, Long Term Monitoring (LTM) for shallow groundwater was implemented in July 2001. LTM was implemented because some inorganics in shallow groundwater exceeded screening values during the Pre-RI, including Federal Maximum Contaminant Levels (MCLs) and/or North Carolina Water Quality Standards (NCWQS). Five monitoring wells were installed in the area of the removal action to monitor inorganics in shallow groundwater at Site 85. Groundwater monitoring was performed for on a quarterly basis for the period of one year and three months (July 2001 through July 2002) to ensure that levels of inorganics in groundwater are acceptable according to state standards. Groundwater monitoring has insured that contamination is no longer impacting the shallow groundwater at Site 85 and the inorganics in groundwater are acceptable according to Federal and/or state standards. It has been determined through the removal action and post removal action groundwater monitoring that no potential human health risks are posed by the inorganics in groundwater.

Decision documents of this type can fall into four categories. The category into which a site is placed is determined by the investigation(s) that have been conducted at the site. They are divided as follows: Category I - NFA decision is based on the results of a Preliminary Assessment (PA), a PA supplement, or an equivalent effort; Category II - NFA decision is based on the results of a Site Inspection (SI), a SI supplement, or an equivalent effort; Category III - NFA decision is based on the results of a RI and, if required, a Feasibility Study (FS), or an equivalent effort; Category IV - NFA decision is based on the completion of a removal action or remedial action (including interim actions), or an equivalent effort.

Site 85 is a Category IV designation. The Pre-RI Screening Study determined that further investigations were warranted, and a removal action with post removal groundwater monitoring was performed to support the NFA decision at this site. The Pre-RI Screening Study completed at Site 85 provides sufficient information about the history and nature of the site and subsequently recommended that a remedial action was needed for the removal of battery piles and associated contaminated soil. This non-time critical removal action (NTCRA) was completed and documented by the Remedial Action Contractor (RAC). Confirmatory soil sampling provides sufficient verification that the source of contamination has been removed and this site requires no further action. Post removal action groundwater monitoring also provides sufficient verification that the source of contamination has been removed and is no longer impacting the shallow groundwater at Site 85. Therefore, a Category IV - NFA DD is herein presented in accordance with all Category IV requirements.

The objectives of this NFA DD for Site 85 are:

- To briefly describe the location, history and environmental setting of Site 85 and its relationship to MCB, Camp Lejeune;
- To describe the current status of the site based on the results of the related investigations; and
- To assess the potential risks to human health at the site.

Data and evaluations from the Pre-RI Screening Study (Baker Environmental, Inc. [Baker], 1998), Engineering Evaluation/Cost Analysis (EE/CA) (Baker, September 10 1999), Action Memorandum (AM) (Baker, September 17 1999), Closeout Report (OHM Remediation Services Corp. [OHM], December 2000) and post removal groundwater monitoring were used to derive and support no further action for Site 85. The Pre-RI Screening Study was initiated to detect and characterize potential impacts to human health and determined that the site required further investigative work. The investigation included soil sampling, temporary monitoring well installation, groundwater sampling and a site survey. Through the Pre-RI Screening Study, it was determined that Site 85 required remediation through a NTCRA for the battery piles and associated contaminated soil. An EE/CA was prepared for the remedial alternatives to address the inorganics in Site 85 soil and the chosen alternative was documented in the AM. The Closeout Report prepared after the removal action at Site 85 contains confirmatory sampling data that verifies the removal of contamination. Post removal action groundwater monitoring was performed on a quarterly basis for the period of one year and three months (July 2001 through July 2002) to ensure that levels of inorganics in groundwater are acceptable according to Federal and/or state standards. Groundwater monitoring has insured that contamination is no longer impacting the shallow groundwater at Site 85 and the inorganics in groundwater are acceptable according to Federal and/or state standards.

### **1.1 Site Location and Description**

To provide the reader with the entire framework of Site 85, the following subsections discuss site locations and descriptions for both MCB, Camp Lejeune and Site 85.



### **1.1.1 MCB, Camp Lejeune**

MCB, Camp Lejeune is located on the coastal plain of North Carolina in Onslow County. The facility is bisected by the New River and encompasses approximately 236 square miles (of which approximately 40 square miles is water, made up by the New River and its tributaries). The New River flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The southeastern border of MCB, Camp Lejeune is the Atlantic Ocean shoreline. The western and northeastern boundaries of the facility are U.S. Route 17 and State Route 24, respectively. The city of Jacksonville borders MCB, Camp Lejeune to the north.

Construction of MCB, Camp Lejeune began in April 1941 at the Hadnot Point Industrial Area, where major functions of the base are centered today. The facility was designed to be the "World's Most Complete Amphibious Training Base". The MCB, Camp Lejeune complex consists of six geographical and operational locations under the jurisdiction of the Base Command. These areas include Camp Geiger, Montford Point (which includes Camp Johnson), Courthouse Bay, Mainside, the Rifle Range Area and the Greater Sandy Run Area. Marine Corps Air Station (MCAS) New River is operationally under the control of MCAS Cherry Point. However, MCB, Camp Lejeune is responsible for the facilities and environmental management of MCAS New River. Site 85 is located within the Camp Johnson support operations area. Site 85 was used as a battery dump in the 1950s.

### **1.1.2 Site 85**

As shown on Figure 1-1, Site 85 is located within the Camp Johnson support operations area in the northern portion of the MCB, Camp Lejeune. Figure 1-2 shows the boundary and features of the surrounding area. Site 85 is located to the northwest of Coolidge Road within a network of improved and unimproved roads. The area is heavily vegetated and contains downed trees from previous hurricanes and storms. The approximate size of the area of concern is 4.5 acres. Currently, the roads surrounding Site 85 are used for vehicle training and support operations.

The flat topography of MCB, Camp Lejeune is typical of seaward portions of the North Carolina coastal plain. Elevations on the base vary from sea level to 72 feet above mean sea level (msl); however, most of the base is between 20 and 40 feet above msl. At Site 85, the site topography is relatively flat. Standing water occurs after heavy rains in low areas that have been graded for roads

and other vehicle training. Due to the absence of paved roads or sewer installation, overland runoff from rainfall is expected to be minimal.

## **1.2 Site History and Enforcement Activities**

Site 85 was used as a battery dump during the 1950s. During the Pre-RI investigation, battery remnants, possibly from the Korean War, were uncovered during road grading and were visible in selected areas. The batteries were generally in piles along the side of the unimproved roads. The battery piles were composed of severely corroded and/or burned individual batteries and battery packs. The battery packs were approximately 10 inches long and 5 inches wide. The piles of batteries ranged in size from 2 feet wide by 2 feet long, to 10 feet wide by 20 feet long. The battery piles ranged in height from one to three feet. During the Pre-RI investigation there were seven distinct battery piles identified at the site. The former battery piles found during the Pre-RI are identified on Figure 1-2. During the removal action a total of 16 battery piles were identified and removed as shown on Figure 1-3.

There are currently no enforcement activities at the site.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) states that sites which the USEPA determines to need no additional evaluation are given a "No Further Response Action Plan (NFRAP)" designation within the CERCLA Information System (CERCLIS). Through this designation, no supplemental investigation or remediation work will be performed at the site unless new information is presented indicating that the initial decision was not appropriate. This NFA DD presents the pertinent information that supports the conclusion that Site 85 poses little or no potential threat to human health.

### **1.2.1 Investigative Activities**

No previous investigations pre-dating the Pre-RI Screening Study were conducted at this site to determine the presence or absence of contamination. Baker was requested by the Navy to collect soil and groundwater samples as part of the Relative Risk Ranking System (RRRS) Study in 1995. A portion of the field work was completed in September 1995 with additional sampling as part of the Pre-RI Screening Study. The Pre-RI Screening Study included sampling of surface and subsurface soil and groundwater, evaluating the resultant analytical data and performing a qualitative and

quantitative risk assessment. This study provided the information necessary to determine whether the site had contributed hazardous substances to the environment. The study concluded that further investigation and/or remediation was required at Site 85. An EE/CA was prepared for identification and analysis of removal action objectives and alternatives and proposal of the remedial action. The AM documented the proposed removal of the source of contamination (battery piles) and up to one foot of soil below ground surface (bgs), or until the soil remedial action levels were met. Upon completion of the excavation, the Closeout Report documented that remedial action objectives have been met. Even though the source of contamination had been removed, LTM was implemented in order to monitor inorganics in the shallow groundwater. Post removal action groundwater monitoring was performed on a quarterly basis for the period of one year and three months (July 2001 through July 2002) to ensure that levels of inorganics in groundwater are acceptable according to Federal and/or state standards. Groundwater monitoring has insured that contamination is no longer impacting the shallow groundwater at Site 85 and the inorganics in groundwater are acceptable according to Federal and/or state standards. The following subsections provide a summary of the results of the Pre-RI Screening Study, EE/CA, AM, Closeout Report and LTM.

#### 1.2.1.1 Pre-RI Screening Study

The field work for the Pre-RI Screening Study was completed by Baker in September 1995 with the subsequent final report completed in November 1998. The field activities included surface and subsurface soil sampling and groundwater sampling.

The soil samples were analyzed for Target Analyte List (TAL) metals, cyanide, toxicity characteristic leaching procedure (TCLP) metals and pH. The sample points were concentrated around the seven visible battery piles. Groundwater was analyzed for TAL metals (total and dissolved). Soil, groundwater and battery locations identified during the Pre-RI are shown on Figure 1-2.

Tables 1-1 through 1-3 contain criteria used at the time of the Pre-RI Screening Study to evaluate sampling data for each media. These criteria included USEPA Risk Based Concentration (RBC) values, USEPA Soil Screening Levels for transfer from soil to groundwater, North Carolina Water Quality Standards (NCWQS), Federal Maximum Contaminant Levels (MCLs) and twice the average Base specific background concentrations for inorganic analytes. RBCs are promulgated by the USEPA Region III as a tool to determine potential risk to human health from contaminants in soil and groundwater. Region III RBC values were derived using conservative USEPA promulgated default

values and the most recent toxicological criteria available. RBCs for potentially carcinogenic and noncarcinogenic chemicals were individually derived based on a target Incremental Lifetime Cancer Risk (ILCR) of  $1 \times 10^{-6}$  and a target Hazard Quotient (HQ) of 1.0, respectively. For potential carcinogens, the toxicity criteria applicable to the derivation of the RBC are oral and inhalation cancer slope factors; for congener carcinogens, they are chronic oral and inhalation reference doses. For noncarcinogens, each RBC value was reduced by a factor of 10 to ensure that chemicals with additive effects are not prematurely eliminated during screening (USEPA, 1993).

#### *Surface Soil*

A total of five surface soil samples were obtained at Site 85 and submitted for TAL inorganic analyses only. Table 1-1 provides a summary of positive detections of inorganics detected in surface soils and the respective screening criteria.

Eighteen of 23 TAL metals were detected among the five surface soil samples obtained from Site 85 (antimony, beryllium, silver, selenium and thallium were not detected). Fifteen metals (arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, sodium, vanadium and zinc) were detected at concentrations greater than twice the average base-specific (i.e., MCB, Camp Lejeune) background levels. The analytes that exceeded the USEPA Soil Screening Levels were arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc. Inorganics that exceeded RBC values included arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury and zinc. Consequently, these analytes were retained as surface soil Contaminants of Potential Concern (COPCs).

#### *Subsurface Soil*

A total of 10 subsurface (i.e., greater than one foot bgs) soil samples were collected at Site 85 and submitted for TAL inorganic analyses only. Table 1-2 provides a summary of the metals detected in the subsurface soil and the respective screening criteria.

Seventeen of 23 TAL inorganics were detected among the 10 samples (antimony, beryllium, cobalt, selenium, silver and thallium were not detected). Ten metals (aluminum, arsenic, copper, iron, lead, manganese, mercury, nickel, vanadium and zinc) were detected at concentrations greater than twice the average base-specific (i.e., MCB, Camp Lejeune) background levels. Inorganic analytes that

exceeded RBC values include aluminum, arsenic and iron. Consequently, these analytes were retained as subsurface soil COPCs. The analytes that exceeded the USEPA Soil Screening Levels were iron and mercury.

#### *Groundwater*

The groundwater investigation at Site 85 entailed the collection of samples from three temporary monitoring wells and analysis for TAL metals only. Table 1-3 provides a summary of the metals detected in the groundwater and the respective screening criteria. The temporary monitoring wells were installed to monitor the shallow water-bearing zone, approximately 20 to 35 feet bgs.

Nineteen of 23 TAL metals were detected among the three groundwater samples obtained from Site 85 (antimony, silver and selenium were not detected). Of the positive detections, aluminum, cadmium, chromium, iron, lead, manganese, mercury and nickel exceeded the respective NCWQS or Federal MCLs. Tapwater RBC values were exceeded by aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, vanadium and zinc. Consequently, these analytes were retained as groundwater COPCs.

In summary, analytical testing of the soil and groundwater samples at Site 85 detected inorganics in all samples. Inorganics in each media exceeded either state and/or Federal promulgated values. Those analytes that exceeded the particular media RBC values were retained as the media COPCs. Based on results of the Pre-RI Screening Study, a NTCRA was recommended for Site 85.

#### 1.2.1.2 Engineering Evaluation and Cost Analysis

The EE/CA for Site 85 was completed in September 1999. The EE/CA described and proposed remedial alternatives for Site 85. The analyses provided information to compare the alternatives, select an appropriate removal action for the site and demonstrate that the CERCLA removal selection requirements specified in the AM have been met. Each alternative was evaluated individually based on the following criteria listed in the USEPA guidance:

- Effectiveness
  - Protectiveness
  - Use of land disposal alternatives

- Implementability
  - Technical Feasibility
  - Administrative Feasibility
- Cost
  - Capital Cost
  - Operation and Maintenance Cost
  - Other Cost

Paralleling the USEPA guidance, the Navy/Marine Corps Installation Restoration Program (IRP) Manual (2001) recommends that criteria for evaluating removal alternatives include effectiveness to minimize the threat to public health, consistency with anticipated final remedial actions, consistency with applicable or relevant and appropriate requirements (ARARs) and cost effectiveness. These two guidance documents were used to form the basis for the evaluation.

The three alternatives evaluated by the EE/CA were:

- Alternative 1: Institutional Controls
- Alternative 2: Excavation, On-Base Disposal
- Alternative 3: Treatment (Ex-situ Soil Washing)

The preferred alternative for addressing contamination at Site 85 was Alternative 2. Alternative 2 provides the most direct and cost effective solution for the contaminated soil at Site 85 while maintaining the potential for future development of the site. Excavation was determined by conducting confirmation sampling to ensure that all contaminated soil above the risk based remediation goals were removed. The risk based goals used were developed using the USEPA RBC values, USEPA Soil Screening Levels for transfer from soil to groundwater, NCWQS, Federal MCLs and twice the average Base specific background concentrations for inorganic analytes. RBCs are promulgated by the USEPA Region III as a tool to determine potential risk to human health from contaminants in soil and groundwater. The non-carcinogenic residential soil screening levels are found by multiplying the RBCs by 0.2. This is a conservative approach to account for potential synergistic effects of multiple contaminants. The risk based clean up goals are presented on Table 1-4.

The following rationale was used for choosing an appropriate clean up goal. For the metals detected in the Site 85 groundwater at concentrations exceeding the North Carolina 2L Standards and were also detected in the soil, the USEPA soil screening level for transfer from soil to groundwater was chosen as the clean up goal. For the metals detected in the Site 85 groundwater at concentrations that did not exceed the North Carolina 2L Standards but were detected in the soil, the residential soil screening level was chosen. For the metals not detected in the groundwater but detected in the soil at concentrations that exceeded the RBCs or were risk drivers, the residential soil screening level was chosen. Twice the average background was selected as the clean up goal for aluminum, iron and mercury even though the rationale described above indicates that the soil to groundwater screening levels should be selected as the clean up goal. This is because aluminum and iron are prevalent soil constituents and the mercury soil to groundwater screening level may be technically infeasible. Information concerning the detected concentrations of metals in the soil and groundwater during the Pre-RI at Site 85 can be found in Tables 1-1 through 1-3. The clean up goals are presented in Table 1-4.

#### 1.2.1.3 Action Memorandum

The AM for Site 85 was completed in September 1999. The purpose of the AM was to document the approval of the removal action for Site 85. The AM addressed the NTCRA for the removal of waste batteries and associated soil contaminated with inorganics at Site 85. The objective of the removal action was the elimination of potential risk to public health and the environment associated with the battery piles and the associated elevated inorganic contaminants in soil. The inorganics were remediated to levels within the risk based remediation goal ranges presented in the EE/CA (Table 1-4). With the removal of the soil and batteries, contaminants will cease to impact the groundwater and groundwater quality is expected to eventually return to its pre-contamination state.

#### 1.2.1.4 Closeout Report

The removal action at Site 85 was successfully implemented during the period between October 22, 1999 and December 21, 1999, with the Closeout Report prepared by OHM in December 2000. The remedial activities included the following tasks:

- Excavating contaminated soil and battery piles;



- Conducting confirmation sampling to ensure that all contaminated soil above the risk based cleanup goals was removed (Table 1-4);
- Conducting waste characterization sampling;
- Transporting the contaminated soil and batteries to the Base landfill for disposal;
- Backfilling the excavation with clean soil from the site borrow pit; and
- Vegetating all disturbed areas.

The approximate final limits of contaminated surface soil for the battery piles are indicated on Figure 1-3. The total vertical extent of excavation was 1 foot bgs for eight of the piles and two feet bgs for three of the piles. The remaining five piles required further excavation based on the sampling results exceeding the cleanup goals. The final confirmation samples collected after the removal action are below the risk based clean up goals except for three samples of aluminum (7,720 milligrams per kilogram [mg/kg] to 10,700 mg/kg) slightly above the clean up goal of 7,413 (OHM, December 2000). As mentioned during the selection of the risk based clean up goals, aluminum is a prevalent soil constituent across the Base and elevated concentrations of aluminum may not be associated with past disposal practices; therefore, these three concentrations in the subsurface soil above the risk based clean up goals do not warrant further investigation. Table 1-5 summarizes the excavation limits performed for the individual piles. After final excavation, a visual inspection was performed on the surrounding soil. No further evidence of additional visual contamination was noted (OHM, December 2000).

#### 1.2.1.5 LTM

Groundwater monitoring was implemented at Site 85 in order to monitor the shallow groundwater following the removal action. As specified in the EE/CA and AM, the removal of the batteries and soil will prevent impacts of contaminants to groundwater, thereby removing the source of groundwater contamination. Over time, groundwater may return to its normal state and will be monitored to determine the effectiveness of the source removal.

Five monitoring wells were installed at Site 85 using 6 ¼ inch hollow stem augers with a truck-mounted drill rig. These wells were installed in July 2001 and were initially sampled for lead only according to Contract Laboratory Procedures (CLP) protocol. The entire TAL metals were analyzed during the final round of sampling in July 2002. Table 1-6 provides construction details for each of the five monitoring wells included in the monitoring program. The monitoring wells are located in the areas where the battery piles and soil have been removed, specifically; two of the monitoring wells are downgradient of flow direction (85-GW04 and 85-GW05), one monitoring well is located upgradient of the site (86-GW02), one monitoring well is located on a side gradient of the site (85-MW03) and one monitoring well is located in the center area of the excavation area (85-MW01). The locations of the monitoring wells installed at Site 85 and the areas of the NTCRA are shown on Figure 1-3.

Sampling activities were completed and subsequent laboratory analyses were performed according to procedures and methods specified in the Work Plans for Long Term Monitoring and Natural Attenuation Monitoring (Baker, 2002). Based upon previous analytical results, lead was identified as the primary concern that may have leached from the former battery disposal piles into the shallow groundwater at Site 85. Other metals also associated with batteries including cadmium, mercury and zinc were sampled for in July 2002.

Sample information, including monitoring well number, sample identification, time and date of sample collection, sampler's initials and analytical parameters, was recorded on the sample labels and in a field logbook. In addition, all field parameters collected prior to sample collection to ensure aquifer stabilization were recorded in the field logbooks. Summaries of groundwater field parameters for all five monitoring events are provided in Table 1-7.

### *Groundwater*

The groundwater monitoring at Site 85 entailed the collection of samples from five monitoring wells. LTM activities at Site 85 began in July 2001 and were sampled on a quarterly basis for the period of one year and three months, thus providing five rounds of analytical data. The first four rounds of groundwater sampling, from July 2001 to April 2002, were analyzed for lead only. The last round of groundwater sampling, during July 2002, was analyzed for the entire TAL. Lead was only detected once during the five sampling events at monitoring well 85-GW01 at a concentration of 3.0 J micrograms per liter (µg/L). This concentration is below the NCWQS for lead of 15 µg/L. The single detection of lead is shown on Table 1-8. During the last sampling event in July 2002, the only

inorganic above the NCWQS was iron detected in three samples ranging from 504 to 3,720 µg/L as shown on Table 1-9. These concentrations of iron are below the Base background data for metals in shallow groundwater of 32,700J µg/L (Baker, August 2002) and therefore, do not warrant further investigation.

In summary, the post source removal monitoring at Site 85 has been completed with five rounds of analytical data below the Federal and/or state standards, except for iron that is below the Base background data for metals in shallow groundwater (Baker, August 2002). Based on these findings, the removal action performed for the source of contaminants impacting the groundwater has been successful and no further action is warranted at this site.

### **1.2.2 Regulatory Agency/Public Involvement**

The USEPA and NC DENR have been actively involved with the investigation of this site through report review and partnering meetings. Based on the results, no further remedial actions are recommended at this site. Public involvement is summarized in the following section.

### **1.3 Community Participation**

A public meeting was held at MCAS, New River on August 27, 1996 to discuss the results of the Pre-RI Screening Study. The meeting included members of the local Base community and representatives from MCB, Camp Lejeune, Atlantic Division Naval Facilities Engineering Command (LANTDIV) and Baker. The members of the project team presented the findings of the investigation and discussed the results of the risk assessment. Members of the community were given the opportunity to ask questions and comment on the related information. These comments and questions were immediately and informally addressed at the public meeting.

The AM substantiated the need for a removal action at Site 85, identified the proposed action and explained the rationale for the selected removal action. A Community Information Sheet was also prepared to provide public notice of the proposed action. This Community Information Sheet was made available on October 6, 1998 at the monthly Restoration Advisory Board (RAB) meeting. These documents, along with the EE/CA, were made available for review at the Onslow County Library on October 12, 1998. A final EE/CA, which incorporated comments on the draft EE/CA, was made available for review at the Onslow County Library on September 13, 1999. The final AM was made

available to the public on September 20, 1999. Any questions and comments were immediately addressed.

## **2.0 SUMMARY OF SITE CHARACTERISTICS**

This section summarizes information pertaining to MCB, Camp Lejeune existing background information. In addition, specific information relevant to Site 85 is presented.

### **2.1 Climatology**

MCB, Camp Lejeune experiences hot and humid summers; however, ocean breezes frequently produce a cooling effect. The winter months tend to be mild, with occasional brief cold spells. Average daily temperatures range from 34°F to 54°F in January, the coldest month and 72°F to 89°F in July, the hottest month. The average yearly rainfall is 52.4 inches.

### **2.2 Physiography, Geology and Soils**

MCB, Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The sediments of this province consist primarily of sand, silt and clay. Other sediments may be present, including shell beds and gravel. Sediments may be of marine or continental origin. United States Geological Survey (USGS) studies at MCB, Camp Lejeune indicate that the base is underlain by sand, silt, clay, calcareous clay and partially cemented limestone. The combined thickness of these sediments beneath the base is approximately 1,500 feet.

### **2.3 Hydrogeology**

At Site 85, groundwater was encountered approximately eight feet bgs during the Pre-RI Screening Study. It was noted by Baker field personnel that groundwater extraction at the time of sampling was very slow due to the slow recharge nature of the formation. Based on the site topography and the sites proximity to the New River, the general groundwater flow direction is estimated to be toward the south.

### **2.4 Surface Water**

The dominant surface water feature at MCB, Camp Lejeune is the New River. It receives drainage from a majority of the base. At MCB, Camp Lejeune, the New River flows in a southerly direction

into the Atlantic Ocean through the New River Inlet. The nearest surface water body to Site 85 is the New River which is located approximately one-half mile to the south of the site.

## **2.5     Land Use**

Land use at the Base is influenced by topography and ground cover, environmental policy and base operational requirements. Much of the land within MCB, Camp Lejeune consists of freshwater swamps that are wooded and largely unsuitable for development. In addition, 3,000 acres of sensitive estuary and other areas were set aside for the protection of threatened and endangered species and are to remain undeveloped. Operational restrictions and regulations, such as explosive quantity safety distances, impact-weighted noise thresholds and aircraft landing and clearance zones, may also greatly constrain and influence development (LANTDIV, 1988). The combined military and civilian population of MCB, Camp Lejeune and Jacksonville area is approximately 112,000. Nearly 90 percent of the surrounding population resides within urbanized areas. The presence of MCB, Camp Lejeune has been the single greatest factor contributing to the rapid population growth of Jacksonville and adjacent communities, particularly during the period from 1940 to 1960.

## **2.6     Receptors**

Site 85 is situated in a nonresidential area of MCB, Camp Lejeune that has only been used for training exercises. In the Master Plan for MCB, Camp Lejeune, future residential development of Site 85 is not projected; however, to maintain a conservative approach in accordance with USEPA guidance, the potential exposure pathways associated with future potential residential development were estimated. The risk assessment performed in the Pre-RI recognizes this fact by preparing conceptual site models that included the following receptors:

- Current military personnel
- Future on-site residents (young child [ages 1-6 years] and adult)

The contaminants detected at the site in surface soils, subsurface soils and groundwater can migrate from the various media in several ways, including:

- Vertical migration of contaminants from surface soil to subsurface soil.
- Leaching of contaminants from subsurface soil to water-bearing zones.

- Vertical migration from shallow water-bearing zones to deeper flow systems.
- Horizontal migration in groundwater in the direction of groundwater flow.
- Wind erosion of surface soils and subsequent deposition of windblown dust.



### 3.0 DATA ANALYSIS/RISK ASSESSMENT

The risk assessment completed for the Site 85 Pre-RI Screening Study (Baker, 1998) examined exposure pathways associated with each environmental medium and each human receptor. Pathways were evaluated both qualitatively and quantitatively, considering site conditions and associated receptors. The exposure to current military personnel and future on-site residents from soil and groundwater was considered.

Potential exposure to surface soil may occur by incidental soil ingestion, contaminant absorption through the skin and inhalation of airborne particulates. Surface soil exposure was evaluated for current military personnel and future residential children and adults.

Subsurface soil is available for contact only during excavation activities, so potential exposure to subsurface soil is limited to current military personnel involved in training exercises and maneuvers. Potential exposure to subsurface soil may occur by incidental soil ingestion, contaminant absorption through the skin and inhalation of airborne particulates.

Future residents were evaluated for groundwater exposure at Site 85. At the present time, shallow groundwater in the vicinity of the site is not used as a potable supply for residents or Base personnel. The current water supply wells are set in the deeper Castle Hayne aquifer. In the future, however, (albeit unlikely due to poor transmissivity and insufficient flow) shallow groundwater may be tapped for potable water. Groundwater exposure (ingestion and dermal contact) was evaluated for future residential children and adults.

Tables 1-1 through 1-3 present a summary of the detected constituents at the site. The tables present the ranges of positive detections for each contaminant of concern. During the Pre-RI Study, these detections were compared to RBCs for residential soils and tap water as well as values stipulated by the USEPA Soil Screening Guidance.

As shown on the tables, some metals detected in the surface and subsurface soil samples exceeded their respective screening criteria, specifically arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury and zinc in surface soil and aluminum, arsenic and iron in subsurface soil. The metals aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury and

nickel exceeded screening criteria for groundwater. Each of the detections were considered in the risk assessment completed during the Pre-RI for Site 85.

Based upon the concentration, frequency of detection and risk characterization results, the inorganics in site media warranted further actions to prevent or lessen the potential impact to human health and the environment. To be protective of human health and the environment, a NTCRA was performed on the soils as described in the previous sections. The inorganics in soil were remediated to the risk based remediation clean up goals presented in Table 1-4 and to the excavation depths as presented in Table 1-5. With the removal of the soil and batteries, contamination has ceased to impact the groundwater. Shallow groundwater is not currently used as a potable source at this site and future residential development of this site is unlikely. Based on this information, the future groundwater exposure scenario evaluated in the risk assessment is unlikely to occur.

#### **4.0 DESCRIPTION OF THE NFA ALTERNATIVE**

No evidence exists to suggest that the soil or groundwater are sufficiently contaminated to pose a threat to human health. Those potential risks noted for future exposure scenarios are unlikely due to the projected groundwater use at the site. Therefore, current site conditions and environmental testing data indicated that no further action is warranted at Site 85. Even though the source of contamination has been removed in the soil to risk based remediation goal levels, LTM was implemented to monitor inorganics in shallow groundwater. Groundwater monitoring occurred on a quarterly basis for a period of one year and three months. Concentrations of inorganics detected (if any) were below the NCWQS and/or Federal MCLs, except for iron that is below the Base background data (Baker, August 2002) and does not warrant further investigation. It has been determined through the LTM program that inorganics in groundwater do not pose a risk to human health or the environment based on the levels of inorganics detected in the shallow groundwater at Site 85.

## **5.0      RESPONSIVENESS SUMMARY**

No public comments have been provided on behalf of this NFA DD.

## 6.0 REFERENCES

Baker Environmental, Inc. August, 2002. Base Background Investigation for Metals in Groundwater. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. Marine Corps Base, Camp Lejeune, North Carolina.

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Baker Environmental, Inc. 1998. Final Pre-Remedial Investigation Screening Study Sites 12, 68, 75, 76, 85 and 87. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. Marine Corps Base, Camp Lejeune, North Carolina.

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OHM Remediation Services Corp. August 1999. Final Remedial Action Work Plan for Remediation of Site 85 - Camp Johnson Battery Dump. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. MCB, Camp Lejeune, North Carolina. OHM Project No. 920736.

USEPA, 1993. Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening, Region III Technical Guidance Manual. Region III, Philadelphia, Pennsylvania. January 1993. EPA/903/R-93-001.

## **TABLES**

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**PRE-RI - SURFACE SOIL INORGANIC DATA AND COPC SELECTION SUMMARY**  
**SITE 85, CAMP JOHNSON BATTERY DUMP**  
**NO FURTHER ACTION DECISION DOCUMENT, CTO-0060**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Analyte	Range/Frequency		Comparison to Criteria					
	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Twice the Average Base Specific Background <sup>(1)</sup> Concentration (mg/kg)	No. of Times Exceeded Twice the Average Background Concentration	USEPA Region III RBC Value <sup>(2)</sup> (mg/kg)	Positive Detects Above RBC Value	Soil to Groundwater Soil Screening Level <sup>(3)</sup>	Positive Detects Above Soil to Groundwater Soil Screening Level
Aluminum	1,140 - 3,190	5/5	5,856.083	0	7,800	0	--	--
Arsenic	0.55 - 76.8	5/5	1.322	2	0.43	5	26.2	1
Barium	6.9 - 134	5/5	17.292	2	550	0	848	0
Cadmium	2.1 - 47.1	2/5	0.696	2	7.8	1	2.7	1
Calcium+	91 - 823	5/5	1,372.977	0	--	--	--	--
Chromium	2.3 - 147	5/5	6.607	1	39	1	27.2	1
Cobalt	17.3	1/5	2.046	1	470	0	--	0
Copper	0.88 - 1,870	5/5	7.104	3	310	1	704	1
Cyanide	0.9 - 2.1	2/5	2.905	0	160	0	31.1	0
Iron+	1,480 - 339,000	5/5	3,702.427	2	2,300	2	151	5
Lead	4.9 - 3,030	5/5	23.37	2	400 <sup>(4)</sup>	1	270	1
Magnesium+	62.2 - 118	5/5	202.96	0	--	--	--	--
Manganese	3.8 - 19,700	5/5	18.51	4	160	3	65	3
Mercury	0.35 - 70.7	3/5	0.094	3	2.3 <sup>(5)</sup>	1	0.0154	3
Nickel	3.5 - 117	2/5	3.455	2	160	0	56.4	1
Potassium+	158 - 456	5/5	200.06	3	--	--	--	--
Sodium+	9.7 - 69	5/5	59.013	1	--	--	--	--
Vanadium	4.1 - 13.9	5/5	11.447	1	55	0	520	0
Zinc	5.2 - 63,900	5/5	13.763	4	2,300	1	1,100	2

Notes: This table and risk assessment were prepared during the Pre-RI Screening Study for Site 85 (Baker, 1998).

Shaded areas indicate analyte selected as COPC for human health risk assessment.

+ = Essential Nutrient

-- = No criteria published

<sup>(1)</sup> Soil background concentrations are based on reference background soil samples collected from MCB Camp Lejeune investigations (Baker, 1996).

<sup>(2)</sup> USEPA Region III Risk Based Concentration (RBC) Table (October, 2000)

<sup>(3)</sup> USEPA Soil Screening Levels for Transfer from Soil to Groundwater (May 1996)

<sup>(4)</sup> Action Level for residential soils (USEPA, 1994)

<sup>(5)</sup> Mercuric chloride used as a surrogate

**PRE-RI - SUBSURFACE SOIL INORGANIC DATA AND COPC SELECTION SUMMARY**  
**SITE 85, CAMP JOHNSON BATTERY DUMP**  
**NO FURTHER ACTION DECISION DOCUMENT, CTO-0060**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Analyte	Range/Frequency		Comparison to Criteria					
	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Twice the Average Base Specific Background <sup>(1)</sup> Concentration (mg/kg)	No. of Times Exceeded Twice the Average Background Concentration	USEPA Region III RBC Value <sup>(2)</sup> (mg/kg)	Positive Detects Above RBC Value	Soil to Groundwater Soil Screening Level <sup>(3)</sup>	Positive Detects Above Soil to Groundwater Soil Screening Level
Aluminum	348 - 10,200	10/10	7,413.23	1	7,800	1	--	--
Arsenic	0.32 - 3	9/10	1.971	1	0.43	6	26.2	0
Barium	0.78 - 13.3	10/10	14.37	0	550	0	848	0
Cadmium	0.66	1/10	0.718	0	3.9	0	2.7	0
Calcium+	7.8 - 127	10/10	387.82	0	--	--	--	--
Chromium	0.96 - 11.3	10/10	12.537	0	39	0	27.2	0
Copper	0.35 - 8.8	9/10	2.41	1	310	0	704	0
Iron+	385 - 9,840	10/10	7,134.64	1	2,300	5	151	10
Lead	1.2 - 40.6	10/10	8.264	1	400 <sup>(4)</sup>	0	270	0
Magnesium+	10.6 - 232	10/10	263.40	0	--	--	--	--
Manganese	0.26 - 47.5	10/10	7.99	1	160	0	55	0
Mercury	0.15 - 0.61	2/10	0.129	2	2.3 <sup>(5)</sup>	0	0.0154	2
Nickel	2.6 - 4.4	3/10	3.725	1	160	0	56.4	0
Potassium+	105 - 242	7/10	344.25	0	--	--	--	--
Sodium+	4.7 - 17	10/10	54.57	0	--	--	--	--
Vanadium	1.2 - 20	10/10	13.34	1	55	0	520	0
Zinc	1.1 - 187	10/10	6.668	3	2,300	0	1,100	0

Notes: This table and risk assessment were prepared during the Pre-RI Screening Study for Site 85 (Baker, 1998).

Shaded areas indicate analyte selected as COPC for human health risk assessment.

+ = Essential Nutrient

-- = No criteria published

<sup>(1)</sup> Soil background concentrations are based on reference background soil samples collected from MCB Camp Lejeune investigations (Baker, 1996).

<sup>(2)</sup> USEPA Region III Risk Based Concentration (RBC) Table (October, 2000)

<sup>(3)</sup> USEPA Soil Screening Levels for Transfer from Soil to Groundwater (May 1996)

<sup>(4)</sup> Action Level for residential soils (USEPA, 1994)

<sup>(5)</sup> Mercuric chloride used as a surrogate

TABLE 1-3

**PRE-RI - GROUNDWATER INORGANIC DATA AND COPC SELECTION SUMMARY**  
**SITE 85, CAMP JOHNSON BATTERY DUMP**  
**NO FURTHER ACTION DECISION DOCUMENT, CTO-0060**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Parameter	Groundwater Criteria					Frequency/Range		Comparison to Criteria				
	NCWQS <sup>(1)</sup> (µg/L)	MCL <sup>(2)</sup> (µg/L)	Region III Tapwater RBC Value <sup>(3)</sup> (µg/L)	Federal Health Advisories <sup>(4)</sup> (µg/L)		No. of Positive Detects/ No. of Samples	Concentration Range (µg/L)	No. of Detects Above NCWQS	No. of Detects Above MCL	No. of Detects Above RBC	No. of Detects Above Health Advisories	
				10 kg Child	70 kg Adult						10 kg Child	70 kg Adult
<b>Inorganics</b>												
Aluminum	NE	50/200 <sup>(5)</sup>	3,700	NE	NE	3/3	159,000-429,000	NA	3/3	3	NA	NA
Arsenic	50	50	0.045	NE	NE	3/3	10.9 - 20.2	0	0	3	NA	NA
Barium	2,000	2,000	260	NE	NE	3/3	242 - 548	0	0	2	NA	NA
Beryllium	NE	4	7.3	4,000	20,000	2/3	2.8 - 3.3	NA	0	0	0	0
Cadmium	5	5	1.8	5	20	3/3	4.9 - 24.6	2	2	3	2	1
Calcium+	NE	NE	NE	NE	NE	3/3	2,070 - 6,180	NA	NA	NA	NA	NA
Chromium	50	100	18	200	800	3/3	383 - 821	3	3	3	3	1
Cobalt	NE	NE	220	NE	NE	3/3	7.1 - 20.3	NA	NA	0	NA	NA
Copper	1,000	1,300 <sup>(6)</sup>	150	NE	NE	3/3	55.4 - 173	0	0	1	NA	NA
Iron	300	300 <sup>(5)</sup>	1,100	NE	NE	3/3	119,00-498,000	3	3	3	NA	NA
Lead	15	15 <sup>(6)</sup>	NE	NE	NE	3/3	207 - 512	3	3	NA	NA	NA
Magnesium+	NE	NE	NE	NE	NE	3/3	5,530 - 13,700	NA	NA	NA	NA	NA
Manganese	50	50 <sup>(5)</sup>	73	NE	NE	3/3	228 - 1,270	3	3	3	NA	NA
Mercury	1.1	2	1.1 <sup>(7)</sup>	NE	2	3/3	0.28 - 2.4	1	1	1	NA	1
Nickel	100	100	73	500	1,700	3/3	53.3 - 4,550	2	2	2	1	1
Potassium+	NE	NE	NE	NE	NE	3/3	5,480 - 16,000	NA	NA	NA	NA	NA
Sodium+	NE	NE	NE	NE	NE	3/3	1,850 - 5,580	NA	NA	NA	NA	NA
Vanadium	NE	NE	26	NE	NE	3/3	322 - 908	NE	NE	3	NE	NE
Zinc	2,100	5,000 <sup>(5)</sup>	1,100	3,000	10,000	3/3	93.1 - 3,970	1	1	1	1	0

**TABLE 1-3 (Continued)**

**PRE-RI - GROUNDWATER INORGANIC DATA AND COPC SELECTION SUMMARY  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

**Notes:**

This table and risk assessment were prepared during the Pre-RI for Site 85 (Baker, 1998).  
Shaded areas indicate parameter selected as COPC for human health risk assessment.

<sup>(1)</sup> NCWQS = North Carolina Water Quality Standards for Groundwater

<sup>(2)</sup> MCL = Safe Drinking Water Act Maximum Contaminant Level

<sup>(3)</sup> USEPA Region III Risk Based Concentration (RBC) Table (October, 2000).

<sup>(4)</sup> Longer Term Health Advisories for a 10 kg Child and 70 kg Adult

<sup>(5)</sup> SMCL = Secondary Maximum Contaminant Level

<sup>(6)</sup> Action Level for drinking water.

<sup>(7)</sup> Value for mercuric chloride used as a surrogate.

+ - Essential Nutrient

NE - No Criteria Established

NA - Not Applicable

TABLE 1-4

**NTCRA SOIL CLEAN UP GOALS  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Analyte	Potential Clean Up Goals			Clean Up Goal (mg/kg)
	Residential Screening Level <sup>(1)</sup> (mg/kg)	Soil to Groundwater Soil Screening Level <sup>(2)</sup> (mg/kg)	Twice the Average Base Background Concentration - Subsurface Soil (mg/kg)	
Aluminum	15,600	14.8	7,413	7,413
Arsenic	6.2	26.2	2.0	6.2
Barium	1,100	848	14	1,100
Cadmium	7.8	2.7	0.72	2.7
Chromium	78	27.2	12.5	27.2
Cobalt	940	--	1.6	940
Copper	62	704	2.4	62
Iron	4,600	151	7,135	7,135
Lead	400	270	8.3	270
Manganese	320	65	8.0	65
Mercury	4.6	0.0154	0.13	0.13
Nickel	320	56.4	3.7	56.4
Vanadium	110	520	13.3	110
Zinc	4,600	1,100	6.7	1,100

<sup>(1)</sup> USEPA Region III Residential Soil Risk Based Concentration (RBC) value (USEPA, 1998) multiplied by 0.2. The multiplier accounts for potential synergistic effects of multiple contaminants.

<sup>(2)</sup> USEPA Soil Screening Levels for Transfer from Soil to Groundwater (May, 1996)

-- Criteria not established.

**TABLE 1-5**

**NTCRA EXCAVATION LIMITS  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

<b>PILE DESIGNATION</b>	<b>SIZE (feet)</b>	<b>DEPTH OF EXCAVATION (inches)</b>
1	16x16	24"
2	16x16	0
3	30x30	0
4	18x18	12"
5	12x12	0
6	30x30	12"
7	25x25	12"
8	22x22	12"
9	12x12	12"
10	28x28	24"
11	19x19	12"
12	15x15	0
13	30x30	12"
14	7x7	24"
15	8x8	12"
16	14x14	0

**SOURCE:**

- OHM Remediation Services Corp. December 2000. Final Closeout Report for Remediation of Site 85 - Camp Johnson Battery Dump. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. OHM Project No. 920736.

**TABLE 1-6**

**SUMMARY OF WELL CONSTRUCTION DETAILS  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

<b>Monitoring Well</b>	<b>Date Installed</b>	<b>Boring Depth (feet, bgs)</b>	<b>Well Depth (feet, bgs)</b>	<b>Screen Interval (feet, bgs)</b>	<b>Sand Pack Interval (feet, bgs)</b>	<b>Bentonite Interval (feet, bgs)</b>	<b>Finished Well Apperance</b>
85-GW01	7/23/2001	15.0	15.0	5.0-15.0	3.0-15.0	1.0-3.0	Stick up
85-GW02	7/23/2001	15.0	15.0	5.0-15.0	3.0-15.0	1.0-3.0	Stick up
85-GW03	7/24/2001	15.0	15.0	5.0-15.0	3.0-15.0	1.0-3.0	Stick up
85-GW04	7/24/2001	15.0	15.0	5.0-15.0	3.0-15.0	1.0-3.0	Stick up
85-GW05	7/24/2001	18.0	18.0	8.0-18.0	6.0-18.0	4.0-6.0	Stick up

Notes:

PVC = Polyvinyl Chloride

bgs = below ground surface

TABLE 1-7

**SUMMARY OF GROUNDWATER FIELD PARAMETERS  
JULY 2001 THROUGH JULY 2002  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Well Number Sample Date	Measuring Time	Well Volumes	Field Parameters				
			Temperature (°C)	pH (S.U.)	Specific Conductance (µmhos/cm)	Dissolved Oxygen (mg/L)	Turbidity (N.T.U.)
JULY 2001							
85-GW01 07/26/01	0835	1.0	18.70	4.93	131	--	101
	0840	2.0	18.70	4.90	134	--	94
	0844	3.0	18.40	4.73	140	--	34
	0850	4.0	18.40	4.74	125	--	14
85-GW02 7/26/01	0915	1.0	19.30	4.23	95	--	224
	0919	2.0	18.40	4.57	93	--	43
	0922	3.0	18.20	4.59	91	--	14
	0925	4.0	18.40	4.75	88	--	6
85-GW03 07/26/01	0953	1.0	18.80	4.73	85	--	15
	0957	2.0	18.60	4.50	89	--	14
	1000	3.0	18.70	4.44	88	--	6
85-GW04 7/26/01	1044	1.0	20.20	4.58	47	--	17
	1048	2.0	19.60	4.65	47	--	23
	10582	3.0	19.60	4.48	46	--	18
	1056	4.0	19.50	4.41	47	--	16
85-GW05 07/26/01	1126	1.0	18.30	5.17	169	--	189
	1130	2.0	18.20	4.75	159	--	329
	1136	3.0	17.90	4.75	151	--	127
	1141	4.0	18.00	4.72	143	--	47
	1147	5.0	18.10	4.69	131	--	17
	1153	6.0	18.00	4.68	130	--	12
OCTOBER 2001							
85-GW01 10/13/01	1318	1.0	20.90	5.54	371	1.61	60
	1324	2.0	20.10	5.18	95	1.23	12
	1329	3.0	20.10	4.87	83	1.77	50
	1338	4.0	19.90	4.69	69	1.62	140
85-GW02 10/13/01	1327	1.0	20.80	4.67	82	3.57	160
	1330	2.0	19.90	4.54	77	2.43	22
	1333	3.0	19.60	4.51	77	2.09	11
	1336	4.0	19.40	4.52	76	1.96	4
85-GW03 10/13/01	1335	1.0	21.00	-1.0	90	9.3	7
	1345	2.0	20.00	0	70	6.2	5
	1350	3.0	20.00	0	70	7.4	4
85-GW04 10/13/01	1400	1.0	21.40	6.36	NA	3.44	1
	1405	2.0	20.70	5.33	NA	2.02	50
	1410	3.0	20.20	4.52	NA	1.50	3
85-GW05 10/13/01	1416	1.0	19.40	4.65	76	4.06	8
	1421	2.0	19.00	4.45	72	3.09	11
	1426	3.0	18.90	4.30	72	2.13	4



TABLE 1-7 (Continued)

**SUMMARY OF GROUNDWATER FIELD PARAMETERS**  
**JULY 2001 THROUGH JULY 2002**  
**SITE 85, CAMP JOHNSON BATTERY DUMP**  
**NO FURTHER ACTION DECISION DOCUMENT, CTO-0060**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Well Number	Measuring	Well	Field Parameters				
			Temperature	pH	Specific Conductance	Dissolved Oxygen	Turbidity
JANUARY 2002							
85-GW01 01/12/02	1047	1.0	15.40	5.62	63	NA	0
	1052	2.0	15.80	5.33	58	NA	0
	1052	3.0	15.80	5.35	57	1.00	0
85-GW02 01/12/02	1048	1.0	14.10	5.30	581	NA	0
	1053	2.0	15.50	4.60	193	NA	0
	1057	3.0	15.80	4.24	159	>1.0	0
85-GW03 01/12/02	1054	1.0	15.20	5.99	74	NA	0
	1057	2.0	15.50	4.70	65	NA	0
	1059	3.0	15.40	4.61	63	NA	0
	1101	4.0	15.80	4.66	61	0.9	0
85-GW04 01/12/02	1123	1.0	15.40	4.77	25	NA	1
	1125	1.5	16.00	4.65	22	NA	0
	1127	2.0	16.00	4.54	22	NA	0
	1129	2.5	16.10	4.51	22	NA	0
	1131	3.0	16.30	4.58	21	1.80	0
85-GW05 01/12/02	1135	1.0	16.20	4.92	90	NA	0
	1140	2.0	16.50	4.82	87	NA	0
	1145	3.0	16.40	4.86	87	>1.0	0
APRIL 2002							
85-GW01 04/20/02	0726	1.0	16.20	5.33	92	3.80	39
	0730	2.0	16.00	4.76	88	3.0	25
	0735	3.0	16.00	4.81	85	3.3	14
	0740	4.0	16.00	4.83	84	2.32	28
	0747	5.0	16.20	4.91	82	1.95	22
85-GW02 04/20/02	0740	1.0	16.48	4.35	68	NA	6
	0745	2.0	16.57	4.02	66	NA	1
	0750	3.0	16.32	3.58	67	5.05	0
85-GW03 04/20/02	0805	1.0	16.16	5.01	60	2.52	85
	0809	2.0	15.73	4.06	50	2.02	33
	0820	3.0	16.12	3.97	57	1.01	17
	0825	4.0	15.69	3.67	53	2.10	2
85-GW04 04/20/02	0742	1.0	16.26	4.64	423	6.57	99
	0748	2.0	15.94	4.26	41	3.83	39
	0754	3.0	16.00	4.22	40	3.48	3
85-GW05 04/20/02	0836	1.0	16.80	4.85	87	1.75	41
	0840	2.0	16.80	4.64	87	1.70	17
	0844	3.0	16.70	4.60	89	1.62	5

TABLE 1-7 (Continued)

**SUMMARY OF GROUNDWATER FIELD PARAMETERS  
JULY 2001 THROUGH JULY 2002  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Well Number	Measuring	Well	Field Parameters				
			Temperature	pH	Specific Conductance	Dissolved Oxygen	Turbidity
JULY 2002							
85-GW01 07/26/02	1448	1.0	19.68	7.82	102	3.22	32
	1452	3.0	18.97	6.08	75	2.24	4
	1456	4.0	18.83	5.74	77	2.40	3
	1456	5.0	18.75	5.70	80	2.27	2
85-GW02 07/26/02	1455	1.0	19.20	7.21	90	2.85	3
	1549	2.0	19.00	5.11	86	1.59	2
	1502	3.0	18.73	4.79	85	1.58	1
	1504	4.0	18.59	4.62	84	1.28	0
85-GW03 07/26/02	1503	1.0	20.44	6.91	112	NA	7
	1506	2.0	19.57	5.70	82	NA	8
	1510	3.0	19.44	5.03	80	NA	5
85-GW04 07/26/02	1531	1.0	20.33	5.54	49	NA	15
	1534	2.0	19.71	4.84	45	NA	11
	1537	3.0	19.56	4.58	43	NA	9
85-GW05 07/26/02	1454	1.0	19.22	6.19	82	4.50	9
	1458	2.0	18.82	4.97	90	3.99	6
	1502	3.0	18.74	4.50	92	4.17	3

## Notes:

°C               = Degrees Centigrade  
 S.U.             = Standard Units  
 µmhos/cm      = micro ohms per centimeter  
 mg/L           = milligrams per liter  
 N.T.U.          = Nephelometric Turbidity Units  
 NA              = Not Applicable

**TABLE 1-8**

**SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - JULY 2001 TO APRIL 2002  
SITE 85, CAMP JOHNSON BATTERY DUMP  
NO FURTHER ACTION DECISION DOCUMENT, CTO-0060  
MCB, CAMP LEJEUNE, NORTH CAROLINA**

Monitoring Well	Lead Comparison Criteria		July 2001	October 2001	January 2002	April 2002
	NCWQS	MCL				
85-GW01	15	NE	ND	ND	ND	3.0J
85-GW02	15	NE	ND	ND	ND	ND
85-GW03	15	NE	ND	ND	ND	ND
85-GW04	15	NE	ND	ND	ND	ND
85-GW05	15	NE	ND	ND	ND	ND

Notes:

Concentrations presented in micrograms per liter ( $\mu\text{g/L}$ ).

- J = Estimated Value
- MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).
- NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
- ND = Not Detected
- NE = Not Established

**SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - JULY 2002**  
**SITE 85, CAMP JOHNSON BATTERY DUMP**  
**NO FURTHER ACTION DECISION DOCUMENT, CTO-0060**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Metals	Sample Identification and Analytical Data					Comparison Criteria		
	IR85-GW01-02C 7/26/2002 15:00	IR85-GW02-02C 7/26/2002 15:05	IR85-GW03-02C 7/26/2002 15:15	IR85-GW04-02C 7/26/2002 15:45	IR85-GW05-02C 7/26/2002 15:05	NCWQS	MCL	Base Background
Aluminum	369	326	1240	363	200 J	NE	NE	3,650
Antimony	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	NE	6	NE
Arsenic	2.2 J	2.08 U	2.08 U	2.08 U	2.08 U	10	10	19
Barium	34.3 J	39.4 J	59.8 J	24.4 J	58.6 J	2,000	2,000	143J
Beryllium	0.17 U	0.17 U	0.18 J	0.17 U	0.17 U	NE	4	NE
Cadmium	2.91 U	2.91 U	2.91 U	2.91 U	2.91 U	5	5	NE
Calcium	1170 J	150 J	1130 J	1730 J	872 J	NE	NE	176,000J
Chromium	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	50	100	8.4
Cobalt	3.06 U	3.06 U	3.8 J	3.06 U	3.06 U	NE	NE	5.6J
Copper	2.02 U	2.02 U	2.1 J	2.02 U	2.02 U	1,000	NE	5.1J
Iron	3720	67.4 J	1730	504	17.9 U	300	NE	32,700J
Lead	2.18 U	2.18 U	2.18 U	2.18 U	2.18 U	15	NE	4
Magnesium	1660 J	2280 J	1430 J	346 J	3640 J	NE	NE	11,500
Manganese	23.7	4.3 J	24.2	3.7 J	5.1 J	50	NE	359
Mercury	0.07 U	0.05 U	0.04 U	0.21 U	0.04 U	1.1	2	NE
Nickel	11.92 U	11.92 U	11.92 U	11.92 U	11.92 U	100	100	16.5J
Potassium	1390 U	932 U	1360 U	575 U	550 U	NE	NE	4,410
Selenium	4.33 U	4.33 U	4.33 U	4.33 U	4.33 U	50	50	NE
Silver	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	18	NE	0.95J
Sodium	9410	8710	6460	2970 J	7930	NE	NE	23,000
Thallium	5.01 U	5.01 U	5.01 U	5.01 U	5.01 U	NE	2	NE
Vanadium	4.9 J	4.13 U	4.7 J	4.13 U	4.13 U	NE	NE	11.5J
Zinc	6 J	1.08 U	6.9 J	1.08 U	1.4 J	2,100	NE	129J

## Notes:

Concentrations presented in micrograms per liter (µg/L).

Shading indicates that a concentration exceeds a comparison criteria.

NE = Not Established

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).

Base Background = Camp Lejeune Base Background Investigation for Metals in Groundwater (Baker, August 2002).  
 Shallow base background maximum detections data was used in this table.

## **FIGURES**

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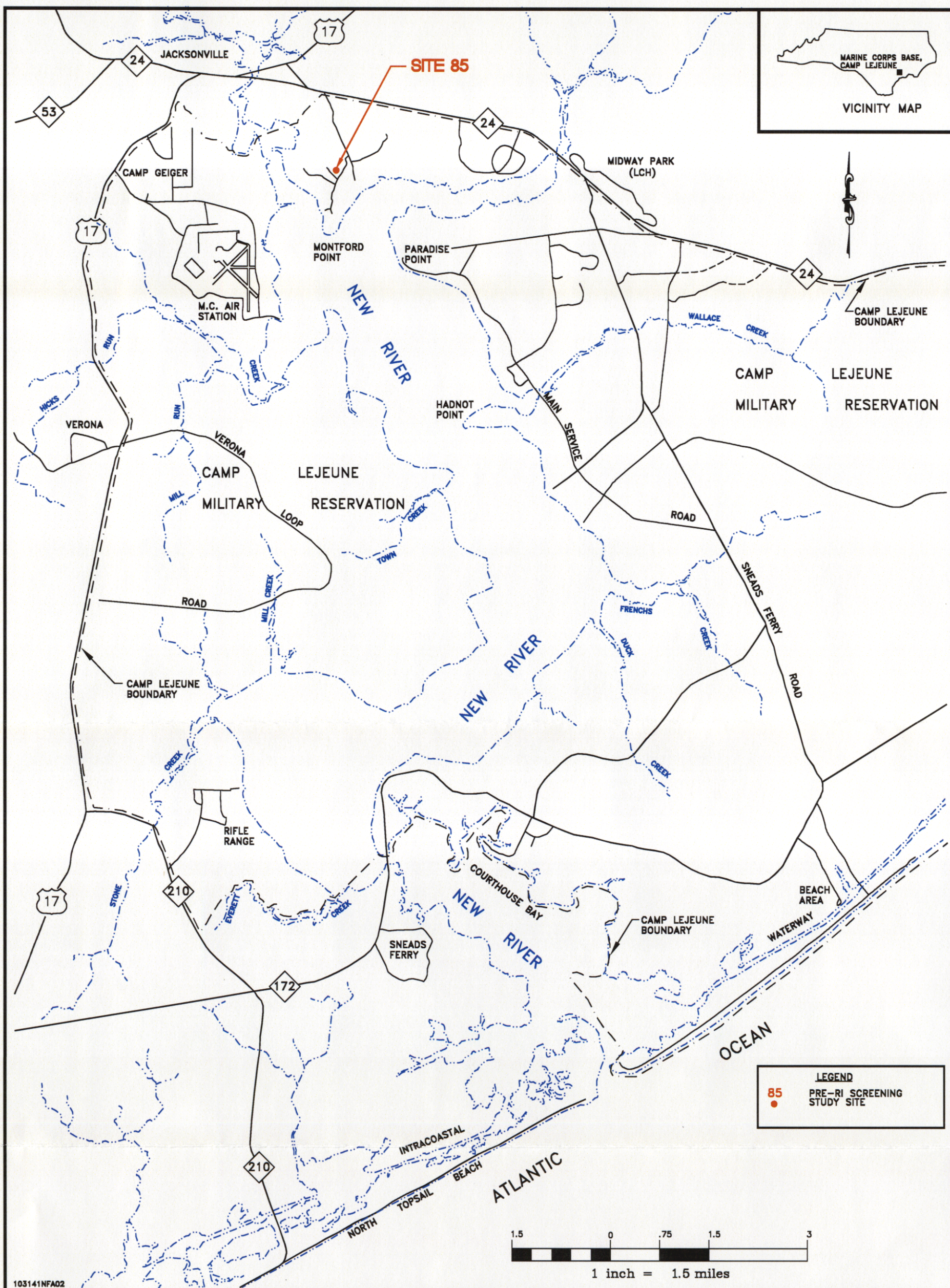
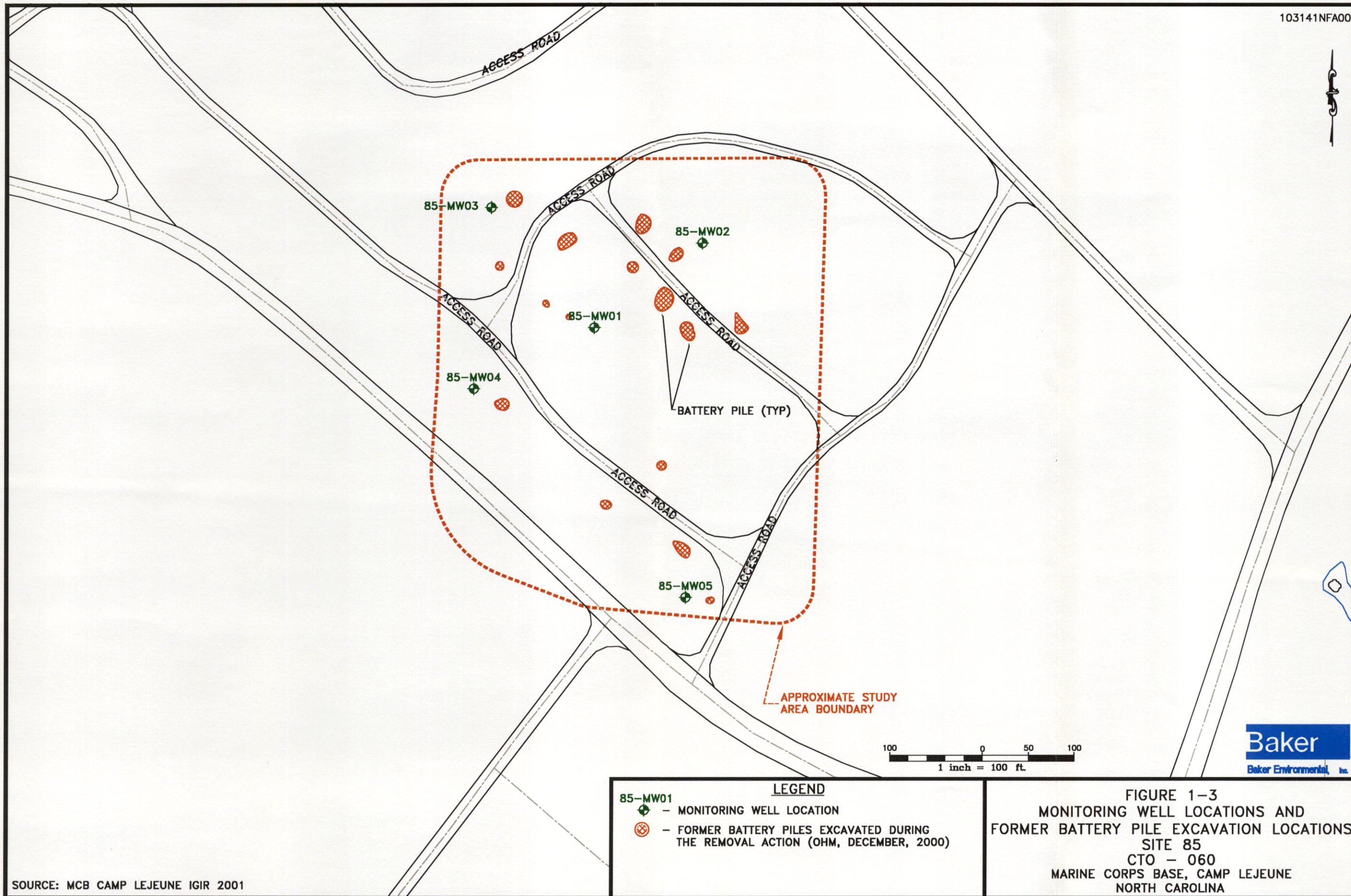


FIGURE 1-1  
SITE LOCATION MAP  
NO FURTHER ACTION DECISION DOCUMENT  
SITE 85  
CTO - 060











**ATTACHMENT A**  
**State of North Carolina Approval Letter**

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North Carolina  
Department of Environment and Natural  
Resources

Michael F. Easley, Governor  
William G. Ross Jr., Secretary  
Dexter R. Matthews, Director



March 4, 2004

Commander, Atlantic Division  
Naval Facilities Engineering Command  
1510 Gilbert Street (Building N-26)  
Norfolk, Virginia 23511-2699

Attention: Mr. Daniel Hood  
Navy Technical Representative  
Code EV23KS

RE: State Concurrence on No Further Action Decision Document  
Site 85 Battery Dump  
MCB Camp Lejeune, NC  
Soil and Groundwater  
Camp Lejeune, NC6170022580  
Jacksonville, Onslow County, North Carolina

Dear Mr. Hood:

The NC Superfund Section received and reviewed the Draft Final No Further Action (NFA) Decision Document (DD) for the Site 85 Battery Dump Site and concurs with the proposed NFA DD subject to the following conditions:

1. Some minor comments on the document were forwarded to the Camp Lejeune Tier I partnering team on March 3, 2004. These comments should be incorporated into the final signed NFA document.
2. The State's concurrence is based solely on the information contained in the November 2002 NFA DD. Should we receive additional information that significantly affects the conclusions of the NFA, we may modify or withdraw this concurrence with written notice to the Naval Facilities Engineering Command for Camp Lejeune and the EPA Region IV.

1646 Mail Service Center, Raleigh, North Carolina 27699-1646  
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: [www.enr.state.nc.us](http://www.enr.state.nc.us)

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Mr. Daniel Hood  
3-04-2004  
Page 2 of 2

The soil and groundwater have been confirmed by appropriate sampling and analysis to meet State and Federal standards for the contaminants of concern; therefore, CERCLA-defined limitations on the use of the property are not required. If you have any questions or comments, please contact me, at (919) 733-2801, extension 278 or email [David.Lown@ncmail.net](mailto:David.Lown@ncmail.net)

Sincerely,

David J. Lown, PE, LG  
Head, Federal Remediation Branch  
Superfund Section

Cc: Randy McElveen, NC Superfund Section  
Rick Raines, PE, EMD/IR  
Gena Townsend, USEPA

**ATTACHMENT B**  
**USEPA Region IV Approval Letter**

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 4  
ATLANTA FEDERAL CENTER  
61 FORSYTH STREET  
ATLANTA, GEORGIA 30303-8960

April 15, 2003

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4WD-FFB

Commanding General  
Attn.: AC/S, EMD/IRD  
Marine Corps Base  
PSC Box 20004  
Camp Lejeune, NC 28542-0004

SUBJ: MCB Camp Lejeune  
Site 85  
No Further Action Decision Document

Dear Sir:

The U.S. Environmental Protection Agency (EPA) Region 4 has reviewed the above subject decision document and concurs with the selected No Further Action Remedy for Site 85. This remedy is supported by the previously completed Pre-Remedial Investigation Screening Study and Non Time Critical Removal Action.

This remedial action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action and is cost effective.

If there are any questions or comments, I can be reached at (404) 562-8538.

Sincerely,

*Gena D. Townsend*  
Gena D. Townsend  
Senior Project Manager

cc: Rick Raines, Camp Lejeune  
Randy McElveen, NCDENR  
Kirk Stevens, LANTDIV